

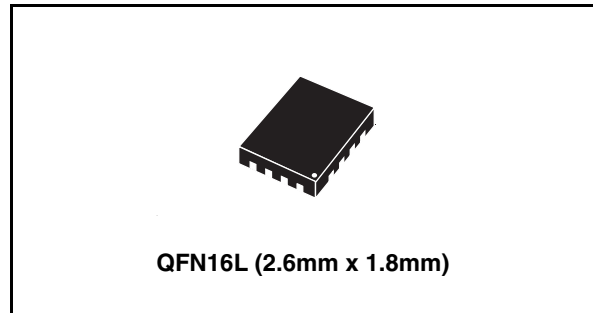


## STG5682

Low voltage dual SPDT switch  
with negative rail capability

### Features

- Distortion-free negative signal throughput down to  $V_{CC}-5.5V$
- Wide operating voltage range:  
 $V_{CC}$  (Opr) = 1.65V to 4.5V single supply
- Ultra low power dissipation:  
 $I_{CC} = 0.2\mu A$  (Max.) at  $t_A = 85^\circ C$
- Low "ON" resistance  $V_{IN} = 0V$ :  
 $R_{ON} = 0.5\Omega$  (max.  $t_A = 25^\circ C$ ) at  $V_{CC} = 4.3V$
- 4.3V tolerant and 1.8V compatible threshold on digital control input at  $V_{CC} = 1.65$  to 3.0V
- Latch-up performance exceeds 300mA (JESD 17)
- ESD performance exceeds JESD22
- 2000-V human-body model (A114-A)



### Description

The STG5682 is a high-speed CMOS low voltage dual analog S.P.D.T. (Single Pole Dual Throw) SWITCH or 2:1 Multiplexer /Demultiplexer Switch fabricated in silicon gate C<sup>2</sup>MOS technology. It is designed to operate from 1.65V to 4.5V, making this device ideal for portable applications.

Additional key features are fast switching speed, Break Before Make Delay Time and Ultra Low Power Consumption. All inputs and outputs are equipped with protection circuits against static discharge, giving them ESD immunity and transient excess voltage.

**Table 1. Device summary**

| Order code | Package                | Packaging     |
|------------|------------------------|---------------|
| STG5682QTR | QFN16L (2.6mm x 1.8mm) | Tape and reel |

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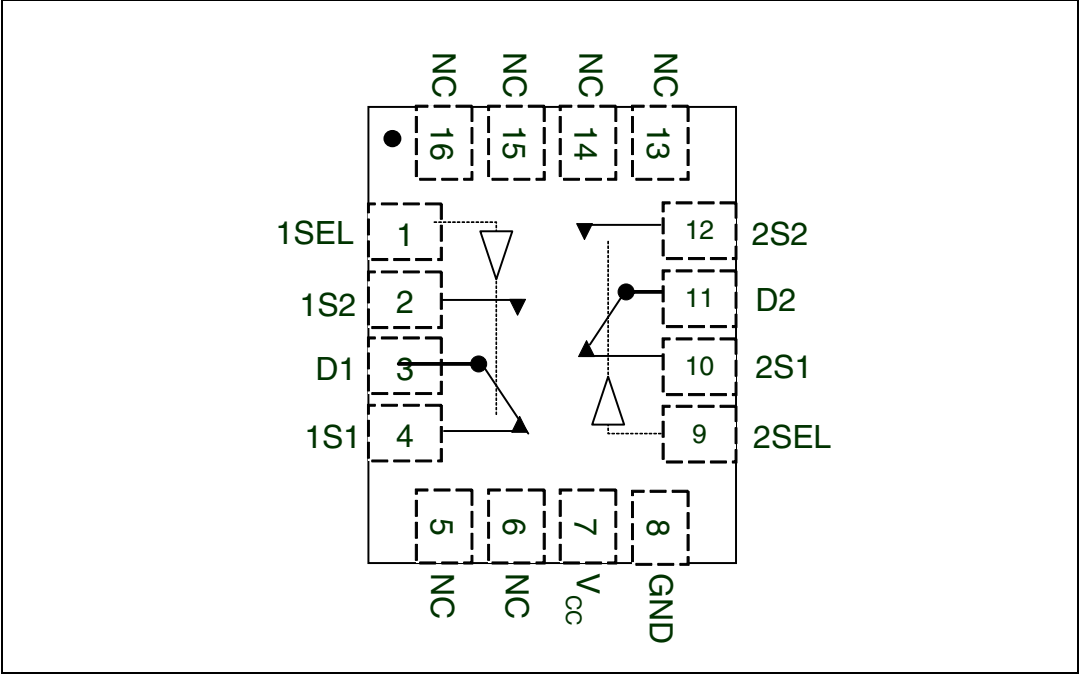
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# 1 Pin settings

## 1.1 Pin connection

Figure 1. Pin connection (top through view)



## 1.2 Pin description

Table 2. Pin description

| Pin N°          | Symbol                | Name and function       |
|-----------------|-----------------------|-------------------------|
| 4, 2,<br>10, 12 | 1S1, 1S2,<br>2S1, 2S2 | Independent channels    |
| 3, 11           | D1, D2                | Common channel          |
| 1, 9            | 1SEL, 2SEL            | Control                 |
| 7               | V <sub>CC</sub>       | Positive supply voltage |
| 8               | GND                   | Ground (0V)             |
| 5,6,13,14,15,16 | NC                    | No connect              |

## 2 Device summary

Figure 2. Input equivalent circuit

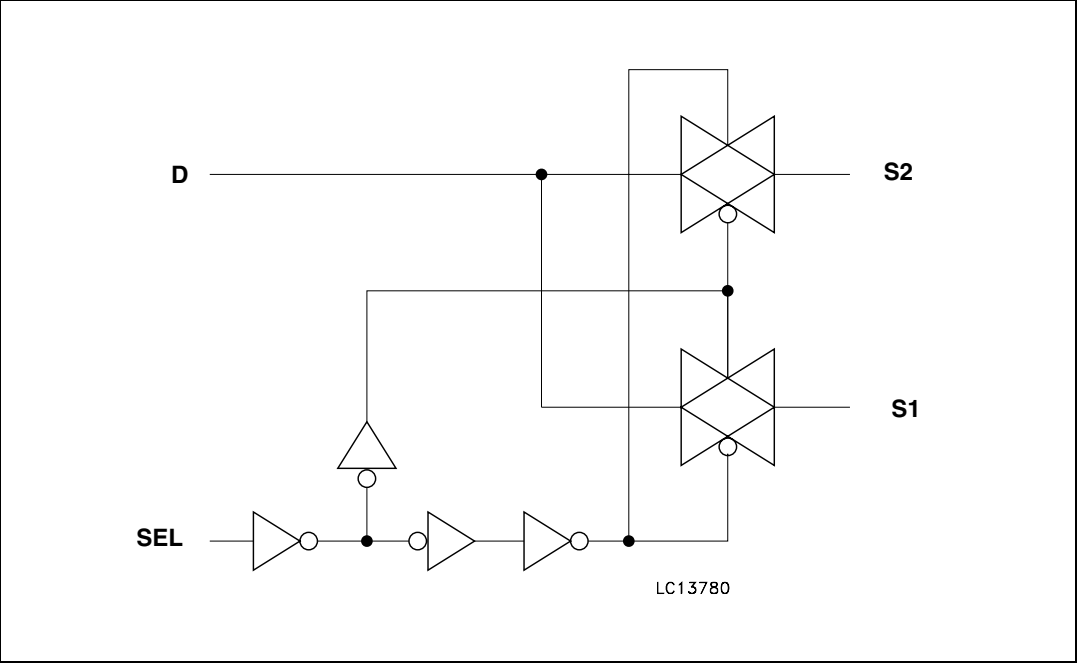


Table 3. Truth table

| SEL | Switch S1          | Switch S2          |
|-----|--------------------|--------------------|
| H   | ON                 | OFF <sup>(1)</sup> |
| L   | OFF <sup>(1)</sup> | ON                 |

1. High Impedance

### 3 Maximum rating

Stressing the device above the rating listed in the “Absolute Maximum Ratings” table may cause permanent damage to the device. These are stress ratings only and operation of the device at these or any other conditions above those indicated in the Operating sections of this specification is not implied. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability. Refer also to the STMicroelectronics SURE Program and other relevant quality documents.

**Table 4. Absolute maximum ratings**

| Symbol                | Parameter                                                | Value                                   | Unit       |
|-----------------------|----------------------------------------------------------|-----------------------------------------|------------|
| $V_{CC}$              | Supply voltage                                           | -0.5 to 5.5                             | V          |
| $V_I$                 | DC input voltage                                         | - ( $V_{CC} - 6.0V$ ) to $V_{CC} + 0.5$ | V          |
| $V_{IC}$              | DC control input voltage                                 | -0.5 to 5.5                             | V          |
| $V_O$                 | DC output voltage                                        | - ( $V_{CC} - 6.0V$ ) to $V_{CC} + 0.5$ | V          |
| $I_{IKC}$             | DC input diode current on control pin ( $V_{SEL} < 0V$ ) | -50                                     | mA         |
| $I_{IK}$              | DC input diode current ( $V_{SEL} < 0V$ )                | $\pm 50$                                | mA         |
| $I_{OK}$              | DC output diode current                                  | $\pm 20$                                | mA         |
| $I_O$                 | DC output current                                        | $\pm 150$                               | mA         |
| $I_{OP}$              | DC output current peak (pulse at 1ms, 10% duty cycle)    | $\pm 400$                               | mA         |
| $I_{CC}$ or $I_{GND}$ | DC $V_{CC}$ or ground current                            | $\pm 100$                               | mA         |
| $P_D$                 | Power dissipation at $T_A = 70^\circ C$ <sup>(1)</sup>   | 1120                                    | mW         |
| $T_{stg}$             | Storage temperature                                      | -65 to 150                              | $^\circ C$ |
| $T_L$                 | Lead temperature (10 sec)                                | 300                                     | $^\circ C$ |

1. Derate above  $70^\circ C$  by 18.5mW/ $^\circ C$

### 3.1 Recommended operating conditions

**Table 5. Recommended operating conditions**

| Symbol   | Parameter                              |                            | Value                      | Unit |
|----------|----------------------------------------|----------------------------|----------------------------|------|
| $V_{CC}$ | Supply voltage <sup>(1)</sup>          |                            | 1.65 to 4.5                | V    |
| $V_I$    | Input voltage                          |                            | $V_{CC} - 5.5$ to $V_{CC}$ | V    |
| $V_{IC}$ | Control input voltage                  |                            | 0 to 4.5                   | V    |
| $V_O$    | Output voltage                         |                            | $V_{CC} - 5.5$ to $V_{CC}$ | V    |
| $T_{op}$ | Operating temperature                  |                            | -40 to 85                  | °C   |
| dt/dv    | Input rise and fall time control input | $V_{CC} = 1.65V$ to $2.7V$ | 0 to 20                    | ns/V |
|          |                                        | $V_{CC} = 3.0$ to $4.3V$   | 0 to 10                    |      |

1. Truth Table guaranteed: 1.2V to 4.3V

## 4 Electrical characteristics

Table 6. DC specifications

| Symbol            | Parameter                                           | Test conditions |                                                                                    | Value                 |      |      |                     |     | Unit |
|-------------------|-----------------------------------------------------|-----------------|------------------------------------------------------------------------------------|-----------------------|------|------|---------------------|-----|------|
|                   |                                                     | Vcc (V)         |                                                                                    | T <sub>A</sub> = 25°C |      |      | -40 to 85°C         |     |      |
|                   |                                                     |                 |                                                                                    | Min                   | Typ  | Max  | Min                 | Max |      |
| V <sub>IH</sub>   | High level input voltage                            | 1.65 -1.95      |                                                                                    | 0.65V <sub>CC</sub>   |      |      | 0.65V <sub>CC</sub> |     | V    |
|                   |                                                     | 2.3-2.5         |                                                                                    | 1.0                   |      |      | 1.4                 |     |      |
|                   |                                                     | 2.7-3.0         |                                                                                    | 1.1                   |      |      | 1.5                 |     |      |
|                   |                                                     | 3.3-4.3         |                                                                                    | 1.3                   |      |      | 1.6                 |     |      |
| V <sub>IL</sub>   | Low level input voltage                             | 1.65-1.95       |                                                                                    |                       |      | 0.5  |                     | 0.5 | V    |
|                   |                                                     | 2.3-2.5         |                                                                                    |                       |      | 0.5  |                     | 0.4 |      |
|                   |                                                     | 2.7-3.0         |                                                                                    |                       |      | 0.6  |                     | 0.5 |      |
|                   |                                                     | 3.3-4.3         |                                                                                    |                       |      | 0.7  |                     | 0.6 |      |
| R <sub>ON</sub>   | Switch ON resistance                                | 1.8             | V <sub>S</sub> = V <sub>CC</sub> -5.5V to V <sub>CC</sub> ; I <sub>S</sub> = 100mA |                       | 3.20 | 4.0  |                     |     | Ω    |
|                   |                                                     | 2.7             |                                                                                    |                       | 0.77 | 0.90 |                     |     |      |
|                   |                                                     | 3.0             |                                                                                    |                       | 0.64 | 0.80 |                     |     |      |
|                   |                                                     | 3.6             |                                                                                    |                       | 0.51 | 0.65 |                     |     |      |
|                   |                                                     | 4.3             |                                                                                    |                       | 0.45 | 0.55 |                     |     |      |
| ΔR <sub>ON</sub>  | ON resistance match between channels <sup>(1)</sup> | 1.8             | V <sub>S</sub> @ R <sub>ON</sub> Max<br>I <sub>S</sub> = 100mA                     |                       | 50   |      |                     |     | mΩ   |
|                   |                                                     | 2.7             |                                                                                    |                       | 20   |      |                     |     |      |
|                   |                                                     | 3.0             |                                                                                    |                       | 15   |      |                     |     |      |
|                   |                                                     | 3.6             |                                                                                    |                       | 15   |      |                     |     |      |
|                   |                                                     | 4.3             |                                                                                    |                       | 15   |      |                     |     |      |
| R <sub>FLAT</sub> | ON resistance flatness <sup>(2)</sup>               | 1.8             | V <sub>S</sub> = V <sub>CC</sub> -5.5V to V <sub>CC</sub> ; I <sub>S</sub> = 100mA |                       | 3.0  |      |                     |     | Ω    |
|                   |                                                     | 2.7             |                                                                                    |                       | 0.50 |      |                     |     |      |
|                   |                                                     | 3.0             |                                                                                    |                       | 0.40 |      |                     |     |      |
|                   |                                                     | 3.6             |                                                                                    |                       | 0.25 |      |                     |     |      |
|                   |                                                     | 4.3             |                                                                                    |                       | 0.16 |      |                     |     |      |
| I <sub>OFF</sub>  | Sn OFF State Leakage Current                        | 4.3             | V <sub>S</sub> = -1.2 to 4.3V<br>V <sub>D</sub> = 4.3 to -1.2V                     | -0.1                  |      | 0.1  | -1                  | 1   | μA   |
| I <sub>ON</sub>   | Sn ON State Leakage Current                         | 4.3             | V <sub>S</sub> = -1.2 to 4.3V<br>V <sub>D</sub> = Open                             | -0.1                  |      | 0.1  | -1                  | 1   | μA   |

Table 6. DC specifications (continued)

| Symbol                            | Parameter                                    | Test conditions |                                                        | Value                 |     |     |             |      | Unit |
|-----------------------------------|----------------------------------------------|-----------------|--------------------------------------------------------|-----------------------|-----|-----|-------------|------|------|
|                                   |                                              | Vcc (V)         |                                                        | T <sub>A</sub> = 25°C |     |     | -40 to 85°C |      |      |
|                                   |                                              |                 |                                                        | Min                   | Typ | Max | Min         | Max  |      |
| I <sub>D</sub>                    | D ON State Leakage Current                   | 4.3             | V <sub>S</sub> = Open<br>V <sub>D</sub> = 4.3 to -1.2V | -0.1                  |     | 0.1 | -1          | 1    | μA   |
| I <sub>IH</sub> , I <sub>IL</sub> | SEL Leakage Current                          | 4.3             | V <sub>SEL</sub> =4.3V or GND                          | -0.1                  |     | 0.1 | -1          | 1    | μA   |
| I <sub>CCLV</sub>                 | Quiescent Supply Current Low Voltage Driving | 4.3             | V <sub>1SEL</sub> , V <sub>2SEL</sub> = 1.65V          |                       | ±37 | ±50 |             | ±100 | μA   |
|                                   |                                              |                 | V <sub>1SEL</sub> , V <sub>2SEL</sub> = 1.80V          |                       | ±33 | ±40 |             | ±50  |      |
|                                   |                                              |                 | V <sub>1SEL</sub> , V <sub>2SEL</sub> = 2.60V          |                       | ±12 | ±20 |             | ±30  |      |
| I <sub>CC</sub>                   | Quiescent Supply Current                     | 4.3             | V <sub>SEL</sub> = V <sub>CC</sub> or GND              |                       |     | ±50 |             | ±200 | nA   |

- Note 1:  $\Delta R_{on} = \max |mSN - nSN|$ , where  $m = 1..4$  and  $n = 1..4$ ,  $N = 1..2$
- Flatness is defined as the difference between the maximum and minimum value of on-resistance as measured over the specified analog signal ranges.

Table 7. AC electrical characteristics ( $C_L = 35\text{pF}$ ,  $R_L = 50\Omega$ ,  $t_r = t_f \leq 5\text{ns}$ )

| Symbol                              | Parameter                    | Test conditions |                                                                                      | Value                 |      |     |             |     | Unit |
|-------------------------------------|------------------------------|-----------------|--------------------------------------------------------------------------------------|-----------------------|------|-----|-------------|-----|------|
|                                     |                              | Vcc (V)         |                                                                                      | T <sub>A</sub> = 25°C |      |     | -40 to 85°C |     |      |
|                                     |                              |                 |                                                                                      | Min                   | Typ  | Max | Min         | Max |      |
| t <sub>PLH</sub> , t <sub>PHL</sub> | Propagation delay            | 1.65-1.95       |                                                                                      |                       | 0.45 |     |             |     | ns   |
|                                     |                              | 2.3-2.7         |                                                                                      |                       | 0.40 |     |             |     |      |
|                                     |                              | 3.0-3.3         |                                                                                      |                       | 0.30 |     |             |     |      |
|                                     |                              | 3.6-4.3         |                                                                                      |                       | 0.25 |     |             |     |      |
| t <sub>ON</sub>                     | Turn-ON time                 | 1.65-1.95       | V <sub>S</sub> = 0.8V                                                                |                       | 180  | 220 |             |     | ns   |
|                                     |                              | 2.3-2.7         | V <sub>S</sub> = 1.5V                                                                |                       | 100  | 130 |             |     |      |
|                                     |                              | 3.0-3.3         |                                                                                      |                       | 72   | 95  |             |     |      |
|                                     |                              | 3.6-4.3         |                                                                                      |                       | 58   | 80  |             |     |      |
| t <sub>OFF</sub>                    | Turn-OFF time                | 1.65-1.95       | V <sub>S</sub> = 0.8                                                                 |                       | 64   | 80  |             |     | ns   |
|                                     |                              | 2.3-2.7         | V <sub>S</sub> = 1.5V                                                                |                       | 41   | 60  |             |     |      |
|                                     |                              | 3.0-3.3         |                                                                                      |                       | 34   | 50  |             |     |      |
|                                     |                              | 3.6-4.3         |                                                                                      |                       | 33   | 50  |             |     |      |
| t <sub>D</sub>                      | Break before make time delay | 1.65-1.95       | C <sub>L</sub> = 35pF<br>R <sub>L</sub> = 50Ω<br>V <sub>S</sub> = V <sub>CC</sub> /2 | 1                     | 110  |     |             |     | ns   |
|                                     |                              | 2.3-2.7         |                                                                                      | 1                     | 58   |     |             |     |      |
|                                     |                              | 3.0-3.3         |                                                                                      | 1                     | 40   |     |             |     |      |
|                                     |                              | 3.6-4.3         |                                                                                      | 1                     | 23   |     |             |     |      |
| Q                                   | Charge injection             | 1.65-1.95       | C <sub>L</sub> = 100pF<br>V <sub>GEN</sub> = 0V                                      |                       | 55   |     |             |     | pC   |
|                                     |                              | 2.3-2.7         |                                                                                      |                       | 76   |     |             |     |      |
|                                     |                              | 3.0-3.3         |                                                                                      |                       | 94   |     |             |     |      |
|                                     |                              | 3.6-4.3         |                                                                                      |                       | 126  |     |             |     |      |

**Table 8. Analog switch characteristics** ( $C_L = 5\text{pF}$ ,  $R_L = 50\Omega$ ,  $T_A = 25^\circ\text{C}$ )

| Symbol          | Parameter                                 | Test conditions |                                                                                                   | Value                 |      |     |             |     | Unit |
|-----------------|-------------------------------------------|-----------------|---------------------------------------------------------------------------------------------------|-----------------------|------|-----|-------------|-----|------|
|                 |                                           | Vcc (V)         |                                                                                                   | T <sub>A</sub> = 25°C |      |     | -40 to 85°C |     |      |
|                 |                                           |                 |                                                                                                   | Min                   | Typ  | Max | Min         | Max |      |
| OIRR            | OFF Isolation <sup>(1)</sup>              | 2.7 - 4.3       | V <sub>S</sub> = 1V <sub>RMS</sub> , f = 100kHz                                                   |                       | -55  |     |             |     | dB   |
| Xtalk           | Crosstalk                                 | 2.7 - 4.3       | V <sub>S</sub> = 1V <sub>RMS</sub> , f = 100kHz                                                   |                       | -60  |     |             |     | dB   |
| THD             | Total harmonic distortion                 | 2.7 - 4.3       | R <sub>L</sub> = 32Ω<br>V <sub>IN</sub> = 0.5V <sub>PP</sub><br>DC Bias = 0<br>f = 20Hz to 20 kHz |                       | 0.01 |     |             |     | %    |
| BW              | -3dB bandwidth                            | 2.7 - 4.3       | R <sub>L</sub> = 50Ω<br>Signal = 0dBm                                                             |                       | 33   |     |             |     | MHz  |
| C <sub>IN</sub> | Control pin input capacitance             | 3.3             |                                                                                                   |                       | 6    |     |             |     | pF   |
| C <sub>D</sub>  | D Port capacitance when switch is enabled | 3.3             | f = 1MHz                                                                                          |                       | 290  |     |             |     |      |

1. Off Isolation =  $20\text{Log}_{10}(V_{\text{D}}/V_{\text{S}})$ ,  $V_{\text{D}}$  = output.  $V_{\text{S}}$  = input to off switch.

## 5 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com)

**Table 9. QFN16L (2.6x1.8mm) mechanical data**

| Dim. | mm.  |      |      |
|------|------|------|------|
|      | Min  | Typ  | Max  |
| A    | 0.45 | 0.55 | 0.60 |
| A1   | 0    | 0.02 | 0.05 |
| b    | 0.15 | 0.20 | 0.25 |
| D    | 2.50 | 2.60 | 2.70 |
| E    | 1.70 | 1.80 | 1.90 |
| e    |      | 0.40 |      |
| L    | 0.35 | 0.40 | 0.45 |

*Note:*

- 1 VFQFPN - Standard for thermally enhanced very fine pitch quad flat package no leads.*
- 2 The leads size is comprehensive of the thickness of the leads finishing material.*
- 3 Dimensions do not include mold protrusion.*
- 4 Package outline exclusive of metal burrs dimensions.*
- 5 Shipping media tape and reel units: 3000*

**Figure 3. Foot print recommendation**

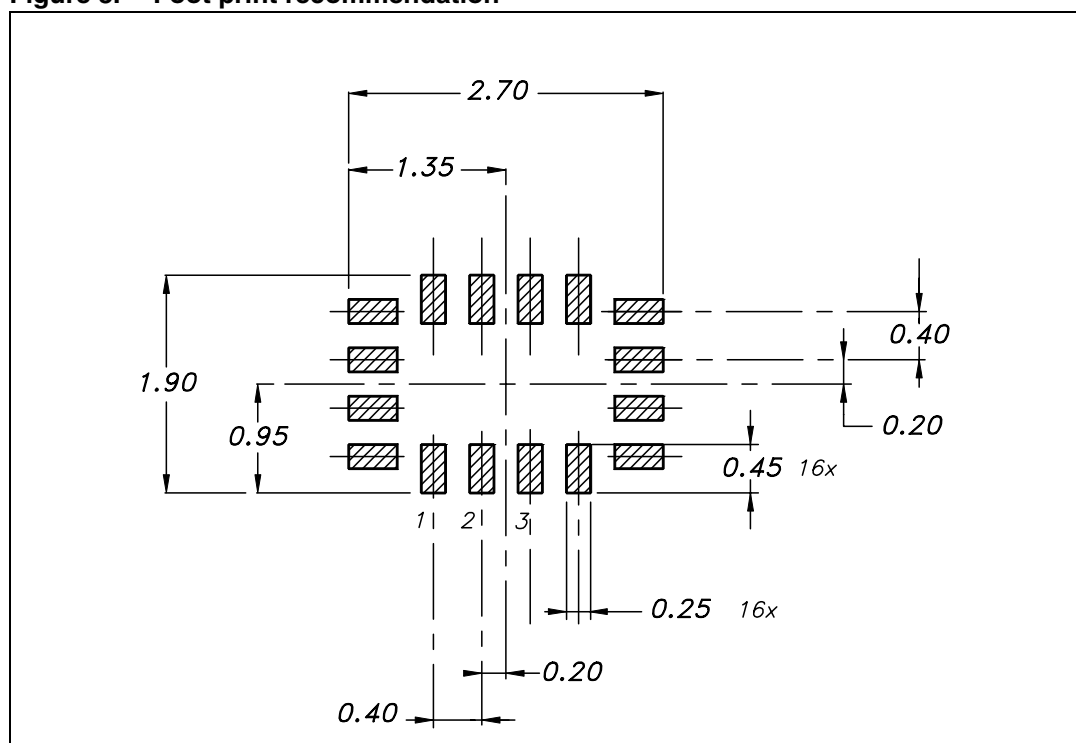
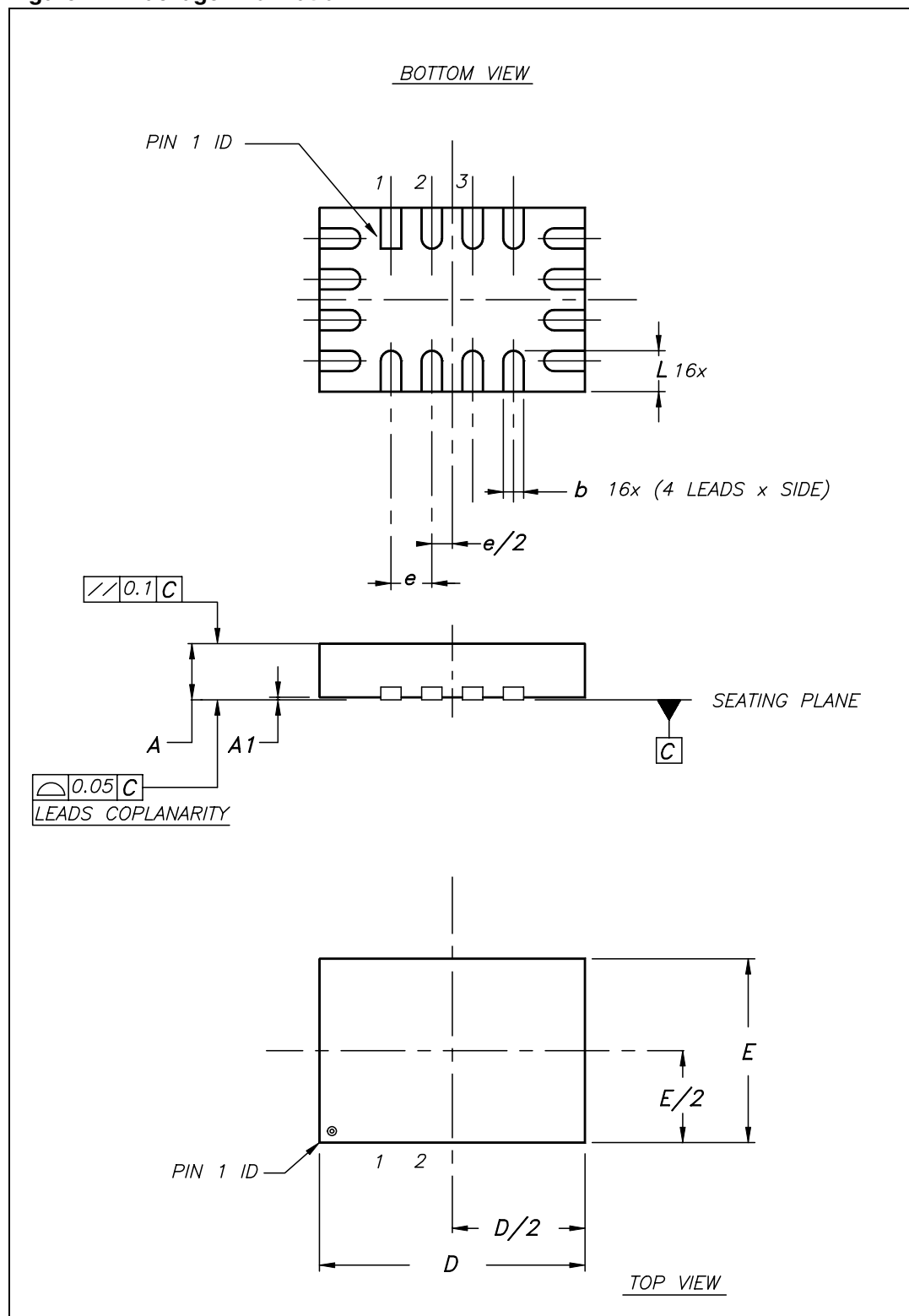


Figure 4. Package information



[illegible]

## 6 Revision history

**Table 10. Revision history**

| Date        | Revision | Changes                                   |
|-------------|----------|-------------------------------------------|
| 15-Mar-2007 | 1        | First release                             |
| 16-Apr-2007 | 2        | Typo in cover page                        |
| 05-Jul-2007 | 3        | <a href="#">Table 6 on page 7</a> updated |

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